

# Working Group 1 Report

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FFAG03, KEK

- Shinji Machida presented a lattice design for a proton driver FFAG
  - ♦  $k = 100$
  - ♦ Magnetic field of 2.4 T; too high for  $H^-$
- Alessandro Ruggiero talked about an FFAG as replacing a SCL

- Carol now says FDF looks better than DFD (still want to hear about scaling)
- Explained why Dejan's lattices looked better than “baseline” lattices
  - ◆ Higher pole tip fields
  - ◆ Shorter drifts between quads
  - ◆ Larger RF gradient needed to get sufficient longitudinal acceptance
  - ◆ Use optimization procedure to make lattice with corresponding parameters from Dejan's lattice: even lower time-of-flight than Dejan.
- Dejan also showed low-energy lattice
- Both Carol and Dejan continued to look at 10–20 GeV lattices

- Bob Palmer implemented the FFAGs in ICOOL
  - ◆ At higher amplitude, time-of-flight dependence gets distorted (becomes asymmetric)
  - ◆ Motion looks good at high amplitude
  - ◆ Soft edges difficult: with only 16 cm gap in Dejan's lattice, fields overlap
  - ◆ Sextupoles didn't cause beam loss, but caused significant distortions
    - ★ Didn't have much effect on time-of-flight range
    - ★ Probably can't increase without beam loss
- François Méot performed nonlinear tracking in a non-scaling lattice with edge fields
  - ◆ For high amplitude motion in  $y$ , particles do not remain near closed orbit in  $x$
  - ◆ Motion stable (but “fuzzy” at 30 mm normalized amplitude)
  - ◆ Fringe fields gives only weak effect

- Aiba talked on longitudinal dynamics
  - ◆ Both minimum and maximum energy must be inside bucket
    - ★ Bunch makes half synchrotron oscillation inside bucket
  - ◆ For SC magnet cases, bucket height not enough in low energy stages
  - ◆ Unusual dynamics in low energy stages since transition energy inside energy range
    - ★ Dynamics more look in non-scaling FFAG
    - ★ Adjust “synchronous phase” to get different behavior
  - ◆ Tried lowering the RF frequency (to 7 MHz); helps

- Yoshimoto: FDF vs. DFD in scaling lattices
- Aiba and Garren: semi-scaling lattice